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GEOLOGICAL SURVEY OF QUEENSLAND.
Publication No. 235.

RECORDS—No. 3.

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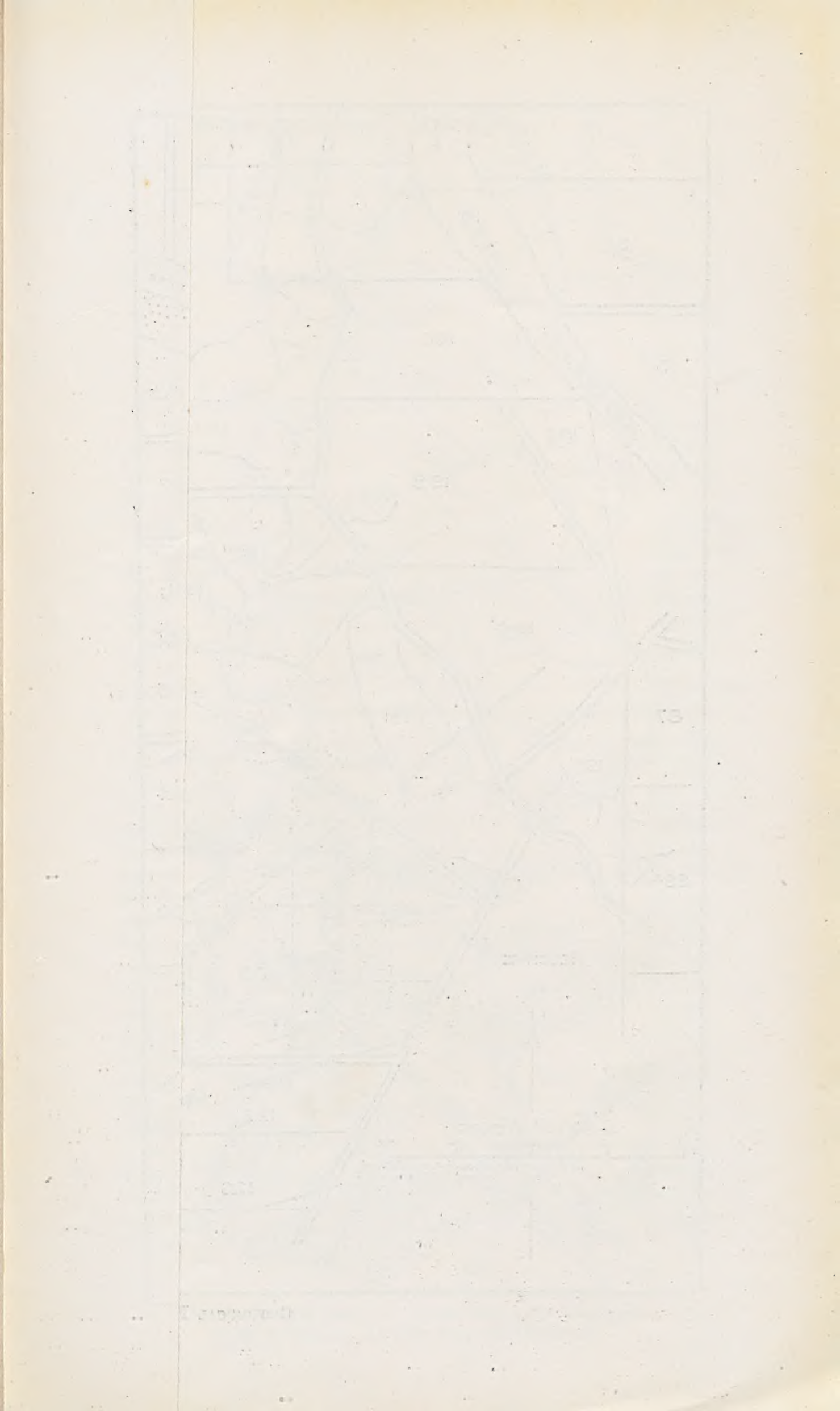
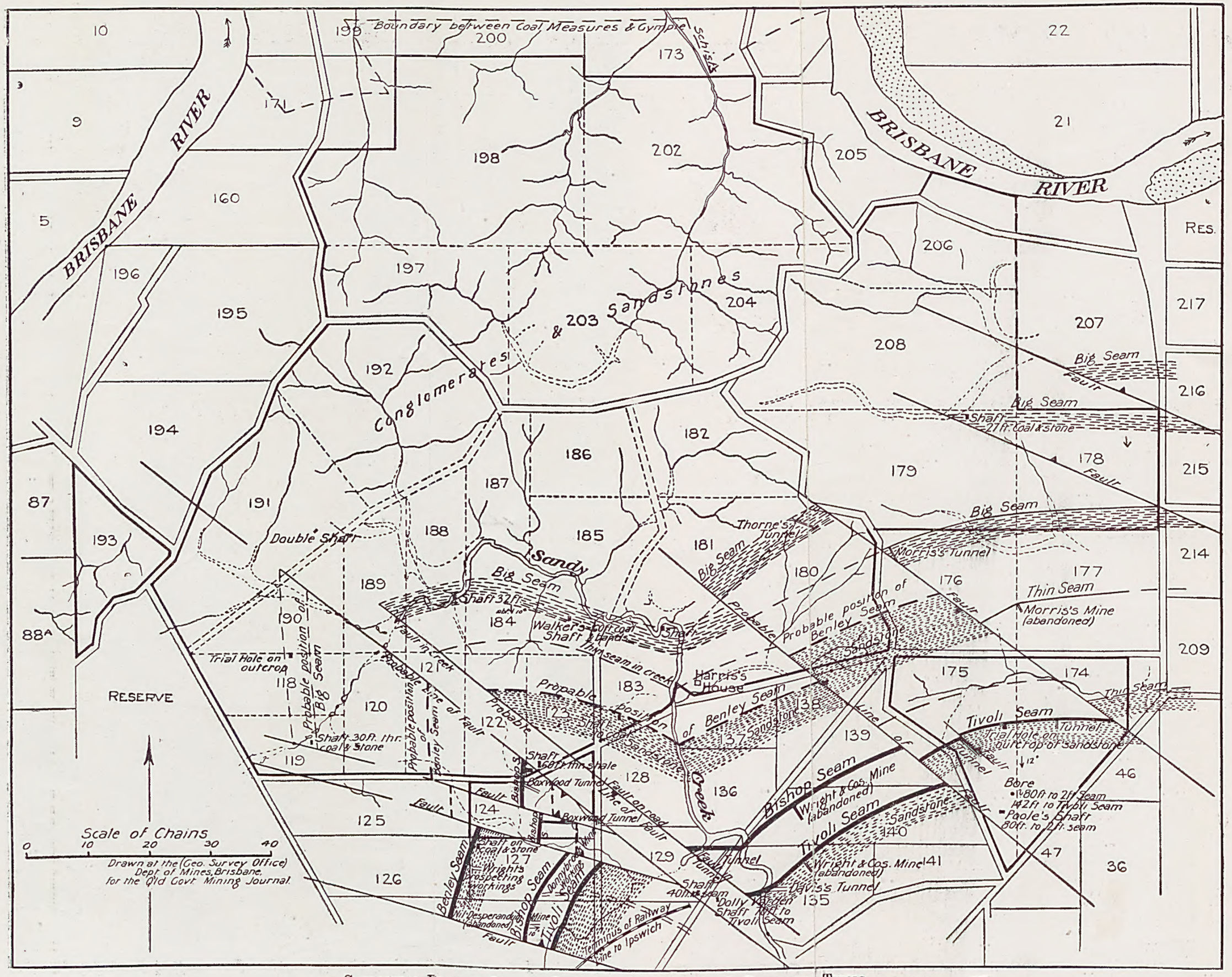




GEOLOGICAL PLAN OF IPSWICH COAL AND COKE COMPANY'S PROPERTY, TIVOLI.

By W. E. Cameron, Assistant Government Geologist.

I. Coal on the North Ipswich Coal and Coke Company's Property, North Ipswich.

By W. E. Cameron, B.A., Assistant Government Geologist.

This property, held by the Ipswich Coal and Coke Syndicate, embraces an area of about 1,350 acres lying between the Brisbane and Bremer Rivers, north of Ipswich, the boundaries being shown in heavy lines on the accompanying geological plan.

This area is underlain by beds of the Ipswich Coal Measures Series, the beds represented being those lying towards the base of that series and for the most part those stratigraphically below the important coal seams which have been worked in the Rothwell Haigh, Eclipse, Tivoli, Waterstown, and Haighmoor collieries, as well as in other smaller collieries of the North Ipswich, or Tivoli, Mining District. The northern and larger portion of the area is underlain by beds of conglomerate and sandstone of a probable thickness of nearly 1,000 ft., and lying immediately on the quartzites and schists of the Gympie Formation, the boundary between the two formations coinciding roughly with the northern boundary of the property. This series of strata contain some beds of shale and thin coals, but nothing of any likely commercial value has as yet been found. The conditions of sedimentation existing during the formation of this class of strata would probably not be favourable to the formation of thick or horizontally extensive beds of coal, and the prospects are not sufficiently promising to warrant any considerable expense in further prospecting them. Of the seams worked in the North Ipswich collieries, the Benley, Bishop, and Tivoli seams (named in ascending order) occur in some restricted portions of the southern part of the area under consideration, but at present no work is being carried on on any of them. Besides these, a lower seam known as the Big, or Dirty, Seam has been exposed at a number of points. The crops of these seams have been traced by numerous prospecting openings made during the last 20 years, and are drawn on the plan accompanying this report. This prospecting work has been carried out mainly under the supervision of Mr. Harris, of Sandy Creek, the syndicate's manager; and his intimate knowledge of the ground has been of great assistance in the tracing of the crops of the various seams and in determining the positions of the numerous faults by which the seams are shifted over this area. Owing, however, to the absence of exact records of most of the work, the positions of the faults cannot be relied on as absolutely accurate.

The Big, or Dirty, Seam.

The lowest exposed coal is the Big Seam, or Dirty Seam, which can be traced along the bed of Sandy Creek through portions 189, 188, 184, 185, and 183. As exposed in the creek, this seam shows a great thickness of bands of coal and stone, which do not, however, give evidence of containing any workable section of coal. A shaft, known as Walker's Shaft, was sunk to a reported depth of 60 ft. through bands of coal and stone. It does not seem probable that this shaft exposed any workable section of coal, as in that case its abandonment would be difficult of explanation. This seam has also been prospected by a tunnel in the northern extremity of portion 180, and again by a tunnel in the north-western corner of portion 176 (owned by T. Morris); but no great amount of work was done from either, and the only reasonable conclusion appears to be that this seam has been sufficiently well prospected, and that, notwithstanding its great size, it is too much interbedded with bands of stone to be of any value.

About 80 ft. vertically above the top of the Big Seam a thin seam of coal is exposed in the bed of Sandy Creek, near Mr. Harris's house. The trace of the crop of this seam is shown on the plan, and what is apparently the same seam was opened by Morris on portion 177, where about 2 ft. 3 in. of rather stony coal, with two bands of stone, were found. There does not seem much probability of this seam affording any workable coal, but a shallow shaft on portion 183, near the right bank of Sandy Creek, would prove the seam at a very slight expense.

The Benley Seam.

This seam lies at a vertical distance of about 160 ft. above the Big Seam, and is overlain by a thick bed of sandstone, which can be traced round the southern boundary of the property, as shown on the geological plan. It was worked south of the syndicate's property in the Benley Mine on portion 131 (not shown on the plan), immediately south of the Donnybrook tunnel (on portion 127). The following was the section of the coal measures on portion 131, as given me by Mr. Harris on a previous visit to the district:—

Coal, 3 ft.
Shales, 10 ft.
Coal, 4 ft. 3 in. with a 6-in. band of stone.
Sandstone and thin coals, 5 ft.
Coal, 4 ft.

The middle coal was that worked at the Benley Mine on portion 131. It is now being prospected by Wright and Co. near the western boundary of portion 127. The overlying sandstone can be traced through portions 122, 123, 128, 137, 138, and 176, and a shallow hole sunk on portion 183 by Mr. Harris is said to have met the roof of the coal. The coal worked in the Benley Mine does not appear to have been of very good quality, but the crop in portions 121, 122, 123, and

183 should be worth the expenditure of a little money in testing its value in the syndicate's property. An area of 54 acres at least should be underlain by this seam though some of this is likely to be badly faulted.

The Bishop Seam.

The Bishop Seam lies about 150 ft. vertically above the Benley, and is now being worked by Wright and Co. on portions 127, 130, and 133, immediately south of the syndicate's property, from the Donnybrook tunnel, the seam dipping to the east. A fault along the northern boundary of portion 127 throws the seam down into portion 124 of the syndicate's property, but further faults of very considerable throw, cutting across the north-east corner of portion 124, throw the crop of the seam up and out of the syndicate's property into portions 129, 140, and 139. The seam on the syndicate's property in portion 124, between the two faults, has all been worked out from the old Boxwood tunnels.

The seam was worked on portion 140 by Messrs. Wright and Co. by a tunnel near the western boundary of the portion, but the workings have now been abandoned. The approximate position of the outcrop is shown across portions 175 and 174, running down the gully draining their northern boundary. The crop here is hidden by surface soil, and does not appear to have been prospected for in this locality. The abandonment of Wright's workings on portion 140 does not promise well for the existence of a payable seam across portions 175 and 174, as it seems to imply that the seam is deteriorating in value as it is traced to the east. This locality is, however, worth the expenditure of a little money in boring to locate the crop and in opening the seam (if it should run this far) to ascertain its value. There is a probability of over 50 acres on portions 174 and 175 being underlain by this seam.

The Tivoli Seam.

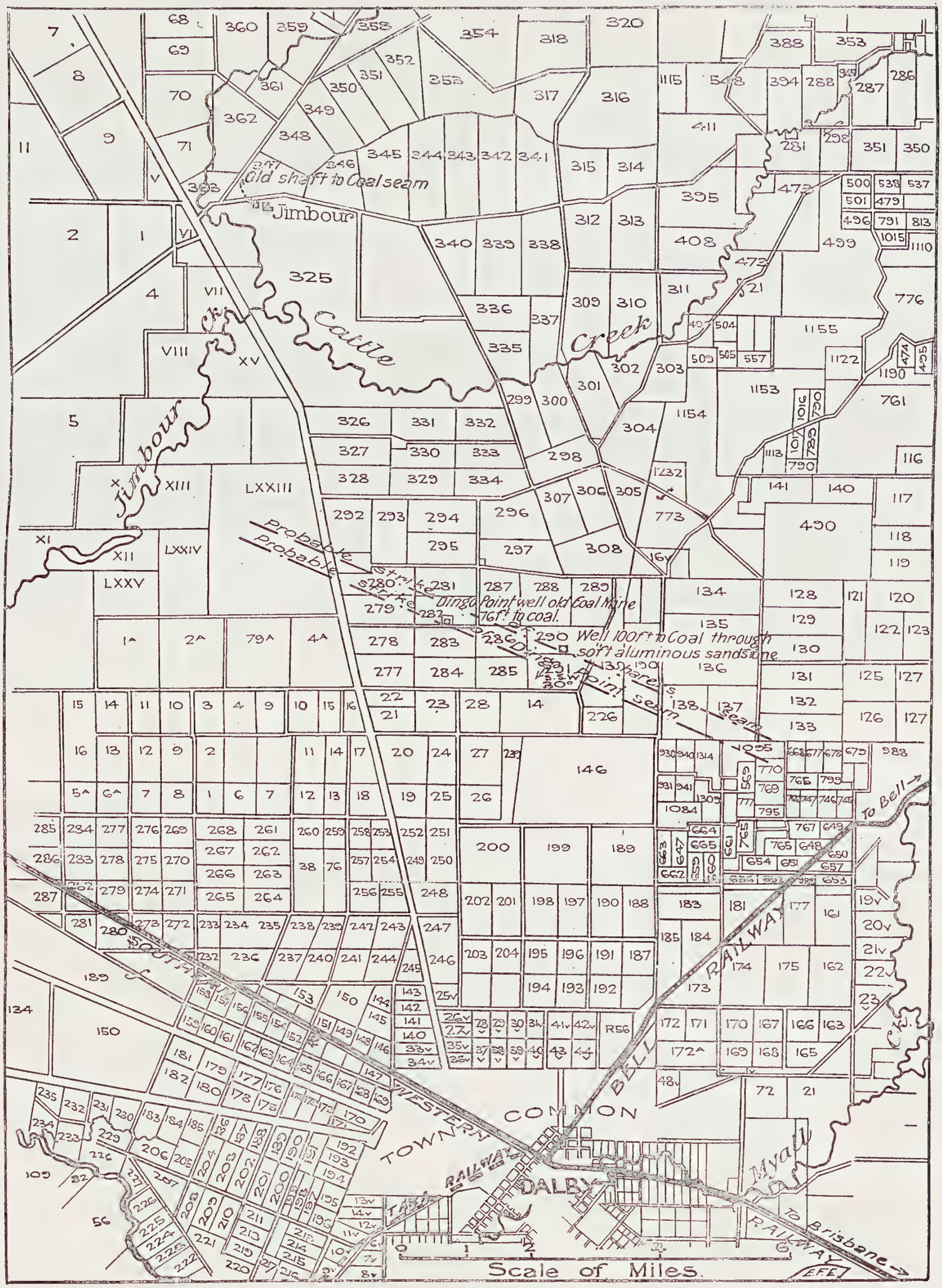
About 120 ft. vertically above the Bishop Seam is situated the Tivoli Seam, which was worked from a tunnel by Wright and Co. in portions 135 and 140, the workings being now abandoned. This seam has been prospected on portion 175 of the syndicate's property by a tunnel near the western boundary, but as the tunnel was driven along a fault, now showing at the entrance to the tunnel, the test can hardly be considered as an exhaustive one. It would be worth the expenditure of a little money to test this seam at a point (about 200 ft., say) east of the tunnel, by sinking a shaft below the sandstone overlying it to the bottom of the coal, with the view of seeing whether a workable section of coal exists here. There is a probability that the whole of the southern part of portions 174 and 175, say 28 acres in extent, is underlain by this seam. There is possibly also an area of 3 or 4 acres containing, say, 8,000 or 10,000 tons of coal of this seam in the south-east corner of portion 124 between the faults met with in the Boxwood tunnels.

Conclusion.

The geological conditions and prospecting work already accomplished do not favour the prospect of there being any large areas of valuable coal in this property, but details have already been given where further prospecting at a small expense may possibly develop small areas of workable coal. These may be again stated in brief thus—

1. Portions 124, 122, and 123 for the Benley seam; possible area of workable coal, about 54 acres, but some of it considerably faulted.
2. Portions 174 and 175 for the Bishop seam; possible area, about 50 acres.
3. Portions 174 and 175 for the Tivoli seam; possible area, about 28 acres.
4. Portion 124 for the Tivoli seam; possible area, 3 to 4 acres.

Brisbane, November, 1910.



SKETCH PLAN, DALBY COAL SEAMS.

2. Coal near Dalby.

By W. E. Cameron, B.A., Assistant Government Geologist.

Situation and Surroundings.

A recent discovery of coal on Sharer's selection, portion 290, parish of Jimbour, was the reason for the present report. This portion lies eight miles due north of Dalby, which is situated on the main western line, 153 miles by rail from Brisbane and 52 miles from Toowoomba. The locality is 7 miles by the nearest road from the Dalby to Bell branch railway, which runs out in a north-westerly direction from Dalby, and about 10 miles by road from that town. The direct line from the discovery to the Dalby-Bell line would be about 5 miles in a south-easterly direction. Coal had been previously worked in the years 1884 and 1885 for a short time at the Dingo Point Mine, on Jimbour Station, about 2 miles west by north from portion 290, and also at Jimbour Homestead, about 8 miles to the north-west; but the absence of a sufficient market has not, up to the present, induced any further exploitation of the possibilities of the district as a fuel-producer. An account of these latter occurrences was given by Sir A. C. Gregory in 1884, and is quoted in Jack and Etheridge's "Geology of Queensland," p. 347. The output of the Jimbour Coal Field is given in the Annual Report of the Department of Mines for 1885 as 2,040 tons, valued at £1,020. No coal appears to have been produced from this field since that year.

Topography and Geology.

The country between Dalby and the coal outcrops is composed of level, open black-soil plains, sparsely timbered here and there with box and gum. These plains are underlain, as shown by the numerous wells of the district, by aluminous sandstones and shales carrying the seams of coal already referred to, as well as other seams which have been probably too thin to attract much attention, but have been recorded from several wells. The general dip of these strata is at a gentle angle towards the south-west. Immediately to the north-east are basalt-covered ridges, forming the foothills of the Bunya Mountains—a portion of the Main Dividing Range, which rises to heights of 3,600 feet above sea level, or nearly 2,500 feet above the town of Dalby. It is the denudation of the basalts of these ridges from the level country to the S.W. which has supplied the rich soils of the plains.

The coal-bearing beds are portion of an apparently continuous belt stretching for about 100 miles to the S.E. past Toowoomba and Warwick, and perhaps for another 200 miles to the north-west, to the head of the Dawson River. These beds belong to the upper

portion of the Trias-Jura System, lying unconformably on older rocks to the north and east, and overlain unconformably to the south-east between Dalby and Roma by the upper cretaceous Desert Sandstone strata. West of Roma, however, they are succeeded conformably by the marine beds of the Lower Cretaceous System, Desert Sandstone having here been denuded sufficiently to remove the evidences of their overlap of the Lower Cretaceous.

The Trias-Jura beds are being worked at Oakey, Kingsthorpe, and Gowrie, on the main western line, situated 33, 40, and 45 miles respectively east of Dalby, the character of the coal at these places being to all appearances the same as that found near Jimbour, and serving, in addition to their general stratigraphical relations, to distinguish these beds from those worked about Ipswich, which contain a more bituminous class of coal.

Details of the Seams.

Sharer's Coal (Portion 290).—The coal on this portion was met with in a shaft at a depth of about 100 feet from the surface. The strata above the coal could not be examined in detail, owing to the timbering of the shaft, but the tip-head showed mostly soft aluminous sandstones, with some bands of black shale. The section of the coal was as follows:—

Coal (with two thin bands not persistent)	15	inches	
Band	½	,,	
Coal	10	,,	
Band	2	,,	3 ft. 11½ in.
Coal	7	,,	
Band	1	,,	
Coal	12	,,	
Bands of coal and stone (probably no workable section)			8 feet.

The above section shows 3 ft. 8 in. of coal with three thin bands which do not appear likely to give much trouble in separation during mining. The smaller bands in the top 15 inches could not probably be easily separated, and in order to get a cleaner coal it might be advisable to leave some of this coal behind. The lower 8 ft. of coal and bands could not be thoroughly examined owing to the difficulty of keeping a candle alight while hanging suspended in the foul air at the bottom of the shaft. From what could be seen it did not appear likely to afford a workable section of coal. A further 3 ft. which had been sunk was covered with water, but the tip showed mostly shales.

The Dingo Point Seam.—Concerning the seam occurring at this point, the late Sir A. C. Gregory, as quoted in Jack and Etheridge's "Geology," p. 347, reported: "At the Dingo Point well the shaft has been sunk through seventy-six feet of surface soil; then three and a-half feet of impure coal, which would make a safe roof, when a seam of coal eight feet thick, but with five bands of shale having an aggregate of one foot, leaving seven feet of workable coal, under which there

is thirteen feet of fireclay and shale, and a second coal-seam four feet thick, with three thin partings of clay; but the lower seam, in consequence of water in the shaft, could not be fully examined."

The section here would therefore be somewhat as follows:—

Impure coal	3 ft. 6 in.	
Coal with five thin bands ...	8 ft.	
Fireclay and shale	13 ft.	
Coal with three clay partings ...	4 ft.	(Could not be fully examined.)

At a first glance it would appear likely that this seam is the same as that found on Sharer's selection, there being about 1½ miles between the two. The top 3 ft. 6 in. of impure coal would then correspond with the top 3 ft. 11½ in. of coal and bands shown in Sharer's selection, the 8 ft. of coal and bands corresponding with the succeeding 8 ft. of coal and bands in the latter. This would give a dip to the coal of about 10 deg. west of south. The dip of the coal at Dingo Point, as given by Sir A. C. Gregory, is, however, about 22½ deg. west of south, which would bring that coal above that found on Sharer's selection; it seems more probable, therefore, that the two seams are distinct, and that there are at least two seams in this neighbourhood of proved workable thickness.

Jimbour Homestead Seam.—No details are available of the thickness of this seam, except that Sir A. C. Gregory remarked that the seam worked there had every appearance of being identical with that worked at Dingo Point. Its position, taken with the dip of the Dingo Point seam, would indicate, however, that it is more probable that it lies at a greater depth stratigraphically than either of the other two, and perhaps constitutes a third workable seam. The character of the surface precludes any attempt at working out the relations of these seams to one another, on account of the almost entire absence of crops of the accompanying strata.

The accompanying plan shows the positions of Sharer's selection, the old Dingo Point shaft (now the site of a windmill), and the shaft at Jimbour Homestead.

Character of the Coals.

The coal from Sharer's selection is a jet black, with brilliant lustre. It is fairly hard, and shows no distinct cleavage. It breaks, and more readily across the stratification planes, with an irregular fracture, the planes of stratification being poorly defined, except where they are made prominent by the occurrence of thin lenticular layers of brighter jet-like coal. Its physical characters and chemical analysis show it to belong to what are now classed by the Geological Survey of

America as sub-bituminous coals. The following are two approximate analyses, made at the Government Chemical Laboratory, viz.:—

ANALYSES OF DALBY COAL FROM SHARER'S SELECTION (PORTION 290, PARISH OF JIMBOUR).

No. 1.

		Calculated to pure coal.
Fixed carbon	42·3 per cent.	51·4 per cent.
Volatile hydrocarbons	39·9 ,,	48·6 ,,
Moisture	5·2 ,,	
Ash (white with slight grey tinge)...	12·6 ,,	
	100 0 ,,	100·0 ,,

No. 2.

		Calculated to pure coal.
Fixed carbon	44·65 per cent.	53·75 per cent.
Votatile hydrocarbons	38·42 ,,	46·25 ,,
Moisture	5·21 ,,	
Ash (white with slight grey tinge)...	11·72 ,,	
	100·00 ,,	100·00 ,,

Sir A. C. Gregory referred (*a*) to the Dingo Point coal as a "free burning long flame," or "cannel coal," but the proportion of fixed carbon in the coal from Sharer's selection is too high for a true cannel. The proportion of fixed carbon in cannel coals, according to F. F. Grout (*b*) ranges from 35 to 48 per cent. of the pure coal. There do not appear to be any analyses of the Dingo Point coal extant, but the following is Sir A. C. Gregory's description of it:—"It is hard and brilliant in fracture, does not soil the hands, and will stand exposure to weather or rough carriage without injury or loss by waste. It ignites with great facility, burns freely with long flame and comparatively little smoke; it does not coke, but burns to a white, heavy ash without any cinder."

Commercial Value of the Coal.

(1) for steam-raising purposes.

The physical characters and chemical analyses of the coal from Sharer's selection show it to be a low-grade bituminous coal, with fairly high ash. The calorimeter test of heating value showed an evaporation of 12·48 lb. of water from and at 212 deg. F. per lb. of coal, which is equivalent to a heating value of 12,051 B.t.u. per lb. of coal. There are no calorimeter tests of Ipswich coals available for comparison, but it is probable, judging by the lower proportion of fixed carbon in this coal, that it is somewhat inferior to the Ipswich coals as a steaming coal. It is to all appearance the same class of coal as those worked at Oakey, Kingsthorpe, and Gowrie, between Dalby and Toowoomba, and at Tannymorel, near Warwick.

(*a*) "Geology of Queensland," &c. Jack and Etheridge, p. 348.

(*b*) "The Composition of Coal," F. F. Grout. "Economic Geology," Vol. III., p. 240.

These coals are used almost exclusively on the railway lines radiating out from Toowoomba and in general industrial work west of the Main Range. Their efficiency as steam producers under the rapid burning conditions prevailing under locomotive boilers is probably not as high as with more bituminous coals, owing to the fact that a large proportion of the heat of combustion passes up the chimney in the form of partly unburned gases. Their efficiency under slower firing conditions may be judged to some extent by the following example:—

The following is an analysis of a sample of Indiana No. 2 coal tested in the fuel-testing plant of the United States Geological Survey at St. Louis in 1905:—

PROXIMATE ANALYSIS OF INDIANA NO. 2 COAL.

		Calculated to pure coal.
Fixed carbon	41·4 per cent.	51·3 per cent.
Volatile hydrocarbons	39·3 ,,	48 7 ,,
Moisture	5·6 ,,	
Ash	13·7 ,,	
	100·0 ,,	100·0 ,,

This analysis shows a coal very similar in character to that found on Sharer's selection, the moisture, however, being higher. The calorific value is given as 12,452 B.t.u., which is somewhat higher than obtained at the Government Chemical Laboratory for the coal from Sharer's selection, being equivalent to an evaporation of 12·887 lb. of water from and at 212 deg. F. The Indiana No. 2 coal, hand-fired under a Heine boiler, gave an evaporation of 7·29 lb. of water, showing an efficiency of ·565 for the coal and boiler under the most advantageous rate of burning and style of firing that could be employed with this boiler. Assuming that the same efficiency could be obtained from the similarly constituted coal found near Jimbour, each pound of this coal would give an evaporation of 7·05 lb. of water in a Heine boiler. As noticed before, it is probable that the result from a locomotive boiler would be somewhat less than this, owing to the highly gaseous character of the coal, but there is every reason to anticipate that these coals will be very useful for steaming purposes where they can, owing to their position, compete against better grades of steaming coals that have to be hauled long distances to the point of consumption. As pointed out by Sir A. C. Gregory for the Dingo Point coal, this coal should resist weather well and stand rough handling without making an undue proportion of slack.

(2) VALUE FOR GAS-MAKING AND HOUSEHOLD PURPOSES.

Speaking of the qualities of the Dingo Point coal, Sir A. C. Gregory, as quoted by Jack and Etheridge (*opus cit.*, page 348), says: "The economic value as a gas coal is about double the average of the Ipswich coals. As a household coal its qualities are excellent, being very clean and burning freely, even in small quantities."

It is not possible to satisfactorily test the gas-making qualities of a coal by means of a small laboratory apparatus, and to demonstrate Sir A. C. Gregory's contention for the coal from Sharer's selection would necessitate the testing of a considerable amount of the coal in an apparatus designed to repeat the conditions obtaining in the commercial process of gas-making. It is probable, however, from the analysis of the coal shown above, that these coals would prove eminently suitable for that purpose. They should also prove excellent household coals.

Market Possibilities.

The most important prospective use for coal near Dalby is for railway locomotive purposes on the lines to the west of that point, the most westerly point at which coal is being worked at present being at Oakey, some 33 miles to the east. The annual consumption of coal on the Government railways east of Dalby is at present about 19,000 tons. With the opening of the Dalby-Tara line and the probable construction of a line branching off from the main line to Taroom, this consumption will probably be increased to something like 24,000 tons per annum within a few years. The finding of suitable coal close to the Bell Railway line near Dalby would save haulage on the present sources of supply of about thirty miles from Oakey, and would consequently give the former coal an advantage of about 2s. 6d. per ton in freight to the point of consumption, or £3,000 per annum on the total consumption. This would probably be sufficient inducement to the Railway Department to obtain as much coal as they required west of Dalby from a local source, if it can be provided of as good quality as that from the present sources of supply. Judging from the general appearance and the analysis of the coal, there does not seem any reason why as good coal should not be supplied from the seams near Dalby as from the present sources of supply at Oakey, Gowrie, and Kingsthorpe, though no analysis of the latter are at present available for more particular comparison. The outlook for an important consumption for gas-making and general steam and household purposes may be expected to improve as the town of Dalby increases as a centre of population.

Future Development of the Field.

Taking the general dip of the coal measures at about S.S.E., as determined by Sir A. C. Gregory for the Dingo Point coal, the strike of the measures would indicate that the probable crop of this seam under the Bell Railway line lies about 8 miles out from Dalby. Taking into account, however, the gentle dip of the measures and the probability of other overlying seams, it is quite possible that workable seams may occur under the Bell Railway much nearer the town, thus saving something in haulage. The depth of the surface soil and flat contours of the country, however, preclude any attempt at finding any

indications from the surface as a guide in prospecting for such seams, and the only means of obtaining any information on this point would be by putting down a series of bores along the railway line. The strike of the coals also cannot at present be determined with any degree of accuracy, and it is quite possible that it runs more to the south, in which case the outcrop of the Dingo Point seam under the Bell Railway line may not be more than 3 or 4 miles out from Dalby; and, as it is a matter of importance to the district to find the coal as near to the present rails and to the main line as possible, it would be well to keep these contingencies in mind in any attempt to develop its coal resources.

Brisbane, 11th July, 1910.

3. Coal near Chinchilla.

By E. O. Marks, B.A., B.E., Assistant Government Geologist.

(Memo. to Under Secretary for Mines, re application from the Chinchilla Colliery Company, Limited, for assistance in prospecting for coal.)

The Chinchilla Colliery Company and its predecessor (the Chinchilla Coal Syndicate) have sunk three shafts in the neighbourhood of that town. The first of these, in portion 13v, parish of Chinchilla, about ¾ of a mile south-west of the railway station, was put down to a depth of 93 ft. From the bottom a jumper bore was put down a further 17 ft. At 7 ft. in the bore, or 100 ft. from the surface, a 10 in. seam of coal was cut, while at the bottom—at 107 ft. to 110 ft. from the surface—a seam estimated to be 3 ft. thick was met with. A heavy flow of water was also struck, and this water in the bottom of the shaft hindered the collection of the débris from the bore. What little was collected has, as is not unusual in such cases, been the prey of the curious shareholders and was not preserved for any useful purpose. A few chips still lying on the surface where the water was bailed out are a nice clean-looking cannel coal.

The records of this, as of the other shafts and wells mentioned below, are from information supplied by those who put them down, it not being possible to inspect personally any of the seams. The accuracy of the information, however, I see no reason to doubt, except in the case of the bores where the estimate of thickness is necessarily more or less a matter of judgment.

The second shaft was situated in portion 2v, parish of Colamba, ¼ of a mile north of the railway, and over a mile north-north-west of the first shaft. In this, which was sunk to a depth of 104 ft., and by boring a further 34 ft., a coal seam 1 ft. in thickness was cut between 60 and 70 ft. from the surface.

Another shaft was then started near the railway line in portion 1,400 (subdivision 2), parish of Colamba, ½ a mile west of Chinchilla Station. It was expected to cut a 3 ft. 6 in. seam at 80 ft. on this site, but there appears to be a complete absence of any grounds on which to base this expectation. At 24 ft. the water became troublesome, and operations ceased pending the purchase of a steam engine and pump. On resuming work, it was found the sides of the lower portions of the shaft had fallen in. A fresh start was then made about 100 yards to the south-west, and this shaft, 6 ft. x 4 ft., is timbered throughout to its depth of 65 ft. No coal or shale was met with.

As far as surface indications in the neighbourhood are concerned, the country is practically a blank, and one would have expected the first choice of a site for prospecting operations to have been, for preference, near the railway. Having been so fortunate as to discover 3 ft. of coal in the first shaft, it is difficult to understand why, especially when the limited resources of the company are taken into consideration, an effort was not made to overcome the water and continue the shaft on to this seam, and so cut a quantity of coal sufficient to make a thorough test. It was certainly a strange move to recommence prospecting a mile away.

While the site of the last operations is a good one, had no work previously been done, it appears to me that in the low financial condition of the company it is unwise to continue further what is at best a purely speculative work; but that, on the other hand, possessing a boiler and pump which would be capable of coping with any water likely to be met with, an endeavour should be made to continue the first shaft the additional 17 ft. to the coal already discovered.

This, or, if it be found necessary, the sinking of another and larger shaft near by, is not a very big undertaking, and if beyond the means of the company, serves to show how incapable the latter would be of further proving and developing the coal seam, if it be found satisfactory in the shaft. Should it not be the expected size and quality, the next search would preferably be made nearer the railway, either by continuing the present shaft or by diamond drilling.

That there is a reasonable prospect of striking workable coal is shown by the several bores and wells in the surrounding country—all, however, at some distance from Chinchilla. The strata met with in these wells and in the company's shafts appear to have a very slight dip and to be otherwise undisturbed. The only difficulty likely to be met with in mining would be the possibility of a bad roof, as most of the sinking done so far has been through a soft aluminous sandstone, which may prove to form a somewhat weak covering to the seams.

In reference to an inquiry from the Railway Department, consequent on a communication from Mr. J. Gredden, of Roma, concerning coal in the neighbourhood of Chinchilla, Mr. Gredden was written to asking for details to enable me to make further inquiries about, or if possible an examination of, the occurrences mentioned. Unfortunately no reply was received from him, but the following information probably includes the coal seams to which he referred.

Between portions 13 and 15, parish of McNulty, 5 miles from Baking Board Siding and 11 miles west of Chinchilla, a well sunk by the Lands Department passed through 10 ft. of coal with some sandstone bands between the depths of 104 and 114 ft.

In portion 110, 1½ miles north-east of Baking Board Siding and 5 miles from Chinchilla, in a well sunk by Mr. Warren, a coal seam varying from 3 to 8 in. in thickness was obtained at the bottom.

In portion 1596, 4 miles south-west of Chinchilla, coal—apparently not of great thickness—outcrops in the bed of Charley Creek.

In portion 93, parish of Colamba, the Lands Department's Burncluith No. 1 Bore, 214 ft. deep, passed through shales, a 6 in. seam of coal at 152 ft., and a 14 ft. seam of bright black coal at 194 ft.

In portion 1518, parish of Earle, 2 miles west of Brigalow, and about a mile from the railway, Mr. Zeller states that 3 ft. 9 in. of coal, dipping slightly to the north-east, was met at a depth of 6 ft. in a gully near the Condamine, and in portion 8, ½ a mile nearer Brigalow, some bands of coal were cut in a bore 130 ft. deep.

In portion 60 (Kleidon's), north-east of Brigalow, about 1½ miles from the station, a 5 ft. 8 in. seam of coal containing a few penny bands were met with in the bottom of a well 188 ft. deep.

In portion 34, Dr. Jack observed coal up to 1 ft. in thickness on the bank of the Condamine.

In a well at Warra, in portion 18v, parish of Thorn, the property of Mr. Burghardt, and also in a shaft some 400 yards distant, from which a quantity of the coal was obtained for test purposes, the following section was met with:—

Coal	2 ft.	10 ins.
Band		2½ ins.
Coal	4 ft.	8 ins.
Sandstone, shales, etc.	13 ft.	10 ins.
Coal	3 ft.	8 ins.

The lower seam is at a depth of 142 and 172 ft. in the two places, the later of which is about ¼ mile from the railway. Mr. Burghardt informed me the sizes of the seams did not vary by more than 2 inches in the two places.

Mr. Burghardt also told me that a test of this coal was made on the railway, but the Railway Department have advised us that they have no record of it. If unable to dispose of the property, it is, I understand, Mr. Burghardt's intention to work the coal himself.

It will be seen from the above list that coal of a workable thickness is reported from six separate localities, four of which are within 2 miles of the railway. Thus, even if the 3 ft. seam said to have been discovered at Chinchilla does not prove satisfactory, there is still a

good prospect for further search in the neighbourhood. I should, however, be disinclined to recommend the granting of any assistance from the Mines Department to the Chinchilla Colliery Company, on the grounds both of the character of the work already done and of the financial inability of the company to develop the coal should it be proved to exist.

The annual consumption of coal by the Railway Department at and west of Chinchilla is 16,000 tons, and the opening of a coal mine at this place would save haulage on the coal of 10 or 20 miles from the Brigalow or Warra seams, or some 80 miles from the present supply. The direct benefit to the Railway Department is obvious, and under the circumstances might render it desirable for the Government to assist at any rate in testing the 3 ft. seam reported.

4. Coal with Glossopteris Flora, near Hughenden.

By E. O. Marks, B.A., B.E., Assistant Government Geologist.

In company with Messrs. E. Cox and G. Oliver, two members of the Galah Gorge Syndicate, an inspection was made of the coal prospecting area (license No. 53) occupied by that syndicate.

This area, 1 mile square, is situated on Mount Sturgeon Run, about 3 miles south-east of Mount Sturgeon, and on the western side of the Gorge of Galah, or Porcupine Creek.

The distance in a direct line from Hughenden is 44 miles (north 25 degrees east), or 41 miles from Prairie Station, on the Northern Railway. The general surface of the country in this neighbourhood is formed by a basaltic plateau, and, though comparatively level, is very rocky. The streams have cut deep gorges in the otherwise even surface, and it is in the gorge formed by Galah Creek that the coal has been discovered. The gorge is some 400 ft. in depth, and the natural section afforded shows the basalt to be from 50 to 100 ft. in thickness, which, however, varies considerably with the unevenness of the old surface on which the basalt was poured out. In one place the base of the basalt is quite half way down the side of the gorge, and the rock has there acquired a columnar structure.

Beneath the basalt are thick-bedded, loose, and porous sandstones, intercalated with occasional beds of grey, sandy micaceous shales including coal seams in at any rate two places.

At one of these the seam occurs near the bed of the creek, and shows 10 in. of coal, beneath which is at least 4 ft. of dark shale, with discontinuous patches of coal. In the few feet of outcrop visible the coal appeared to vary considerably in thickness and quality, and is separated from the sandstone bed above by a foot of grey shale. The following is an analysis (Government Analyst) of this seam (10 inches) :—

Moisture	7·7 per cent.
Vol. Hydro Carb.	19·7 ,,
Fixed Carbon	41·4 ,,
Ash	31·2 ,,
	100·0 ,,

Half a mile further up the gorge, and at some elevation above the creek, another (or perhaps the same) seam has been discovered. In this case the coal is directly underneath a sand-

stone bed, and in the outcrop exposed varies in thickness from 18 to 22 in. A sample taken of this gave the following analysis (Government Analyst) :—

Moisture	14·9	per cent.
Vol. Hydro Carb.	26·5	,,
Fixed Carbon	34·2	,,
Ash	24·4	,,
	100·0	,,

Since no excavation worth mentioning has been made, a really fresh sample of the coal from either seam was not obtainable.

From its appearance in its partly weathered condition, as well as from the second analysis, the coal would perhaps better be classed as a brown coal, showing as it does abundant traces of the vegetable tissues from which it has been derived. The coal is soft, of a dull black colour, with brownish faces, and a dull black powder.

While the strata at the second outcrop have a slight dip to the south, the sections along the gorge show that the beds do not depart appreciably from the horizontal in this locality. To judge by what could be seen, it appears likely that the seams of coal are lenticular, and do not extend individually over any considerable area, for had this been the case they would surely have been observed in other sections, a close examination of the gorge in this vicinity having been made by the prospectors. A layer in one of the beds of grey shale, a few hundred yards down the creek from the first coal seam but on a higher level, is full of impressions of *Glossopteris* leaves, accompanied by *Vertebraria.*

While the seams of coal which have been discovered are not of sufficient thickness on the outcrop—and probably also lack sufficient extension—to warrant any expenditure in opening them up, except for the seams themselves, the strata show but little indication of being coal-bearing. It is, of course, quite possible that other and better seams exist beneath those exposed, but there is certainly not sufficient indication to justify any expenditure on boring or other sinking operations, especially in view of the great distance to any railway communication.

There are, however, exposed in Galah Gorge, and presumably in the gorges of the other watercourses also, numerous excellent natural sections, a thorough examination of which might result in a more valuable discovery, and is certainly worth the making.

Dr. Jack, in 1888, reported on the "Discovery of Coal on the Flinders," 18 miles north 29 deg. west of Coalbrook Station (Warreah), where, however, a workable thickness was not

exposed, and referred the beds in which the coal occurred to the Rolling Downs Formation. Operations were recently carried on in this neighbourhood by the Blantyre Coal Company, two coal seams being reported to have been met with in a bore. A shaft was being sunk to develop these seams, but work was suspended, owing, it is said, to the difficulty of coping with the influx of water.

In 1896 a bore was put down by the Railway Department at Warreah, in search of coal, to a depth of 494 ft., and passed through dark shales and bands of "coal clay," as well as sandstones. Coal has also been met with in bores for artesian water in other places in this district. In 1896 the country from the Cape River and Hughenden to Croydon was reported on by Mr. A. Gibb Maitland, in his report on " The Delimitation of the Artesian Water Area North of Hughenden." In this, Mr. Maitland considers the arenaceous strata observed in the gorges (including Galah Gorge), to be the Blythesdale or water-bearing beds beneath the Rolling Downs Formation, and has included the sandstones on the Cape River, in which Mr. Rands previously observed *Glossopteris*, mapping them as of Lower Cretaceous or Jurassic age.

In this view Mr. Maitland was at variance with Mr. Rands and also with Dr. Jack, who was firmly of the opinion that the beds belong to the (Upper Cretaceous) Desert Sandstone series overlying the Rolling Downs.

The coal-bearing formation in Galah Gorge is presumably the same as that outcroping on the Flinders and met with in the various bores. If this is the case, it belongs either to the Rolling Downs or Blythesdale beds. Mr. Rands's discovery of *Glossopteris*, a fern which is considered the characteristic fossil of the Permo-Carboniferous system in rocks believed to be of Desert Sandstone age, was naturally the cause of considerable interest. The further occurrence, some 60 miles distant, in these rocks is of confirmatory interest, and leaves no doubt of the presence of *Glossopteris* either in the Blythesdale beds—the water-bearing rocks of the artesian system—as mapped by Mr. Maitland, or in the Desert Sandstones as considered by Dr. Jack. The alternative of considering the water-bearing Blythesdale beds to be of Permo-Carboniferous age opens too wide a question to be discussed here. In its hydrous character the coal is similar to the Collie coal of West Australia, the age of which (it is associated with *Glossopteris*) has been the subject of some discussion.

5. Carbonaceous Glossopteris-bearing Strata, near Pentland.

Notes by E. O. Marks, B.A., B.E., Assistant Government Geologist.

Learning that an outcrop of coal was supposed to have been discovered, and a prospecting area applied for, on Betts's Creek, 18 miles from Pentland, the opportunity was taken during my visit to that place in connection with other matters to examine the occurrence in question. The black carbonaceous material which had been mistaken for coal by the finders is a carbonaceous and in places a coaly shale. The coaly stratum which outcrops near the bed of the creek does not appear to be of any considerable thickness, and can be traced, owing to its horizontal position, for upwards of 100 yards along the creek. In this distance the shaley material varies considerably in its carbon contents. It contains an abundance of mica, which renders it very fissile. Over the shale is a conglomerate containing fragments of a somewhat hardened sandstone. Except for the slight irregularities to be expected when a coarse conglomerate is deposited over a soft mud, the conglomerate appears to be conformable with the shale on which it lies. About a mile further up, and on the south bank of the creek, a cutting some 50 ft. high exposes the same or similar conglomerate overlying, apparently conformably, irregularly-bedded sandstones intercalated with lenticular bands of shale similar to, though not quite so carbonaceous as, that previously mentioned. Occasional not very distinct impressions of what appeared, from examination in the field, to be Glossopteris were found in the shaley strata, but were too fragile to preserve.

While there is nothing in the outcrop discovered to justify expenditure in testing this or sinking for other seams, the knowledge that coaly strata are liable to occur in this formation should encourage an examination of the same in the country to the west and northwest. This country, in which Betts's, Warrigal, and Torrens's Creeks rise, and about which very little is known, is said to be poor "Desert" country containing numerous gorges cut by the watercourses. These gorges would form excellent natural sections, probably several hundred feet deep, and should be well worth a thorough examination for coal seams.

The present occurrence is probably some distance further up Betts's Creek than the site where Mr. Rands discovered Glossopteris, referred to in his report on the Cape River Goldfield. It should be recalled that both Dr. Jack and Mr. Rands considered these beds to be Desert Sandstone (Upper Cretaceous). Mr. A. Gibb Maitland, how-

ever, was of the opinion (report on "Delimitation of Artesian Water Area North of Hughenden") that the formation is the Blythesdale Braestone, and so of Lower Cretaceous, or perhaps even Jurassic, age. While the subsequent discoveries of coal in these beds at Blantyre and Galah Gorge, as well as in various artesian bores, favours their being ascribed to the Blythesdale or water-bearing beds, it is interesting to note that one of Mr. Maitland's reasons for considering these rocks to be older than the Desert Sandstone was his observation on Betts's Creek of a conglomerate (considered by him to be Desert Sandstone) containing fragments of an older sandstone.

As stated above, the same, or a similar, conglomerate is apparently contemporaneous with the glossopteris-bearing beds, and, moreover, its included sandstone fragments are of a much harder stone than the sandstones with which the glossopteris occurs, and from which, according to Mr. Maitland's view, the fragments were derived.

6. Gold on Mount Emu Plains Station, Hughenden District.

By E. O. Marks, B.A., B.E., Assistant Government Geologist.

Situation.

The site of the recent discoveries is on the Upper Flinders River, in portion 2, parish of Cracknell, the camp being situated on either side of the river a mile and a half to two miles below the boundary fence dividing portions 1 and 2, the boundary also of Mount Emu Plains and Cargoon Stations. The distance in a direct line from Hughenden is 66 miles, or 55 miles from Pentland. The road from Hughenden, *viâ* Mount Emu Plains, is the one now most used, though there is said to be an equally good road, and of about the same length, *viâ* Cargoon to Pentland. The latter route has the advantage that Pentland is 148 miles by rail from Townsville, as compared with 236 to Hughenden.

The first 28 of the 85 miles of road from Hughenden is mainly over downs country, which forms a good road in dry weather, but is practically impassable in wet. From this onward till the last five or six miles the road gradually ascends, and then traverses the basalt tableland, and, though very rocky, is, with the exception of some black soil near Mount Emu Plains, a reasonably hard road in either wet or dry weather. Though an elevation is attained of 1,500 ft. above Hughenden, or 2,500 above sea-level, the ascent is very gradual, and, but for one or two short pinches, there are no heavy grades in the whole distance.

Seven miles beyond Mount Emu Plains the track leaves the road to Reedy Springs and takes an easterly course, two miles further on descending from the basalt on to the undulating granite country forming the valley of the Flinders. This descent, of some 200 ft., is steep and rough, no effort so far having been made to clear a road. Owing to the altitude, the climate is a pleasant one, and neither flies nor mosquitoes are greatly in evidence.

Geology of the District.

The country rock in which the present discoveries have been made is a portion of the great granite *massif* which stretches from here eastward past the Cape River, Charters Towers, and Ravenswood to the coast, and which is more or less continuous to the north with

the granites of the Croydon, Etheridge, and Walsh and Tinaroo districts. The granite on the Upper Flinders varies from a coarse-grained pink variety, carrying abundance of muscovite, to a finer-grained gray biotite granite. In places the rock has been altered, and all gradations can be observed between the true granite and mica schist. The metamorphic rock, however, does not appear to occupy any considerable area, and has a contorted as well as schistose structure. Mr. A. Gibb Maitland, in his report on the "Delimitation of the Artesian Water Area North of Hughenden"* has mapped the boundary of the granite and schist country about ten miles south of the present camp. Overlying the schist or granite to the south are arenacious strata, the age of which has been the subject of discussion and is of considerable geological interest. These sandstones have been cut into deep gorges by the streams which traverse them, and are overlain by the basalt of the tableland. Though covering an immense area, the basalt appears seldom to exceed a thickness of about 50 ft., and is frequently much less, as observed between Hughenden and Mount Emu Plains. In Galah Gorge an excellent section may be seen showing the horizontal sandstones resting on an uneven surface of metamorphic rocks and covered by the thin layer of basalt.

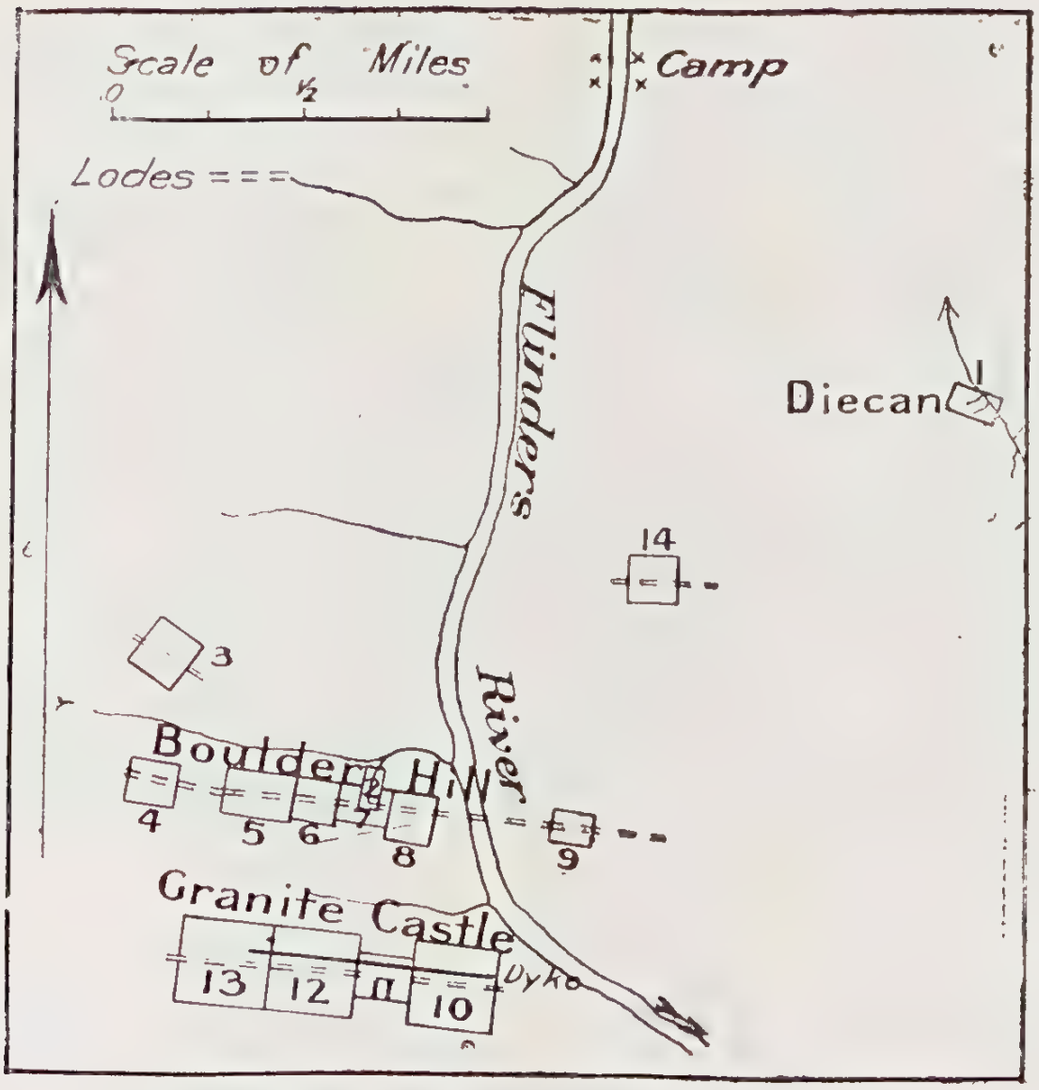
The country in this neighbourhood appears to have been but little prospected, the nearest workings having been at Oxley Creek, 18 miles to the south, where alluvial gold was obtained some 20 years ago, and is referred to in Mr. Rands's report on "The Cape River Goldfield."† Gold and silver-lead ore have also been reported from Chudleigh Park, some 30 miles to the north-west.

Gold Claims.

Diecan Claim (Messrs. Clements, Edwards, and Wood).—This claim (No. 1 on sketch) is on the original discovery, which is said to have been made known in the first place to one of the prospectors by an aboriginal named King. The claim is a mile south-east of the camp on a small creek running northwards. Payable gold has been obtained in two small gullies in the claim itself and on the surface between them, as well as in the creek where the gullies enter it. Neither above nor below this in the creek has anything more than colours been obtained. The gold has been traced at the head of these gullies to a small leader, which has not, so far, been opened up beyond a small hole two feet deep, in which it is two or three inches in thickness and shows visible gold. Some stone—it could not be considered a sample—from this leader assayed (Government Analyst) 66 oz. 16 dwt. gold and 24 oz. 10 dwt. silver per ton. The leader is

* G.S. Publication No. 121.
† G.S. Publication No. 73.

in granite, which, to judge by its weathered condition, has been heavily charged with pyrites. A sample taken over a width of 4 ft. on the north side of the leader assayed 1 oz. 6 dwt. gold and 11 dwt. 4 gr. silver per ton. The gold in this rock—the sample was only a foot or two beneath the surface—may possibly have been washed in.



Sketch Showing Approximate Positions of Claims.

from the disintegration of the leader, but is not unlikely to have been associated with the pyrites in the rock itself. Whichever the origin of the gold, the assay shows the desirability, when work is commenced on the leader, of a thorough testing of the rock on either side.

The gold in the leader itself is probably only a small shoot, and, while satisfactory to the proprietors, is unlikely to lead to permanent mining. The gold obtained on the surface (it can hardly be termed alluvial) occurs largely in quartz, and in some pieces appears to have been deposited in a vein, the walls of which were lined with "dog-tooth" quartz crystals. In one specimen the gold has a beautiful feather-like crystallisation.

Outside the claim the ground has naturally been well prospected, but has failed to yield anything more than mere colours. As the result of five weeks' work 9 lb. of stone sent to Charters Towers yielded 48 oz. of gold, worth £3 1s. 10d. an ounce. The party have constructed a "wet shaker" to facilitate washing the gold, hitherto done in a dish.

Anderson Brothers' Reward Claim (No. 2 on sketch) is situated about two miles south of the camp, on the west side of the river, and is the only claim beside the Diecan in which payable alluvial gold is being obtained. This claim—400 ft. by 50 ft.—is pegged out along a small gully, which flows in a north-easterly direction into a creek running into the Flinders. The gold is found in the gully and on its sides, little being discovered out of it, and has presumably its origin in the "Boulder Hill" lode, which runs across the upper end of the claim, and is referred to later on. The gold is finer than in the Diecan claim, and the wash contains much magnetite, which hinders the saving of the fine gold.

Mineral Claims.

The first discovery of silver-lead ore was a small flat lode running east 30 deg. south, showing 4 or 5 in. of galena, which, however, pinches out in a few feet, the claim (No. 3 on sketch) being abandoned by the prospector. It has since been repegged by Messrs. Burns and Hamilton, though at the time of my visit little effort appeared to have been made to test the outcrop. It was from here that the rich asays were obtained which were published in the Press. The prospector (Mr. Edwards) informed me that first assay was from a picked sample, and the second a more general sample of the ore:—

	Gold.	Silver.	Lead.
No. 1	5 dwt.	423 oz.	63 %
No. 2	13 dwt.	166 oz.	49 %

It is presumably on account of these assays that the other lead-bearing lodes have come to be regarded as silver lodes by the men on the field. Including this claim there are the outcrops of at least three, and probably four, distinct lodes already discovered, the majority of the claims being on two of them. The outcrops have a direction varying, with this one exception, about 10° from due east.

A quarter of a mile south of this is the *Broken Hill Claim* (No. 4 on sketch), held by Messrs. Hunter, Cox, and Oliver. A small hole in the centre of the claim shows the lode 1 ft. wide, but it appears to become smaller to the west. The outcrop runs east 7° south, and a sample of the lode material assayed (Government Analyst)—

Gold	6 dwt. 10 gr. per ton
Silver	3 oz. 2 dwt. 10 gr. per ton
Lead	3·1 %

About 10 chains east of this, and apparently on the same lode, is the *Boulder Hill Claim* (Sellen, Young, and Sellen), to the east of which have been pegged *Boulder Hill No. 1 East* (Bell and Sterling), *No. 2 East* (McKenzie), and *No. 3 East* (Scott). In none

of these claims (Nos. 5, 6, 7, and 8 on sketch, respectively) has any work been done to show the width of the lode, or from which to obtain a sample. Judging from its appearance on the surface, the lode probably does not attain any considerable thickness, though no idea could, of course, be formed as to its value in the precious metals, to ascertain which it should be well tested.

WET SHAKER, DIECAN CLAIM.

In a line with this outcrop, and presumably on the same lode, a claim (*O'Donohue's*—No. 9 on sketch) has been pegged on the eastern side of the river. The outcrop is well marked in places, and some ore, obtained subsequent to my visit, from a 2-ft. width of lode, gave the following (Government Analyst):—

Gold	8 dwt. 14 gr. per ton
Silver	26 oz. 10 dwt. per ton
Lead	25·3 %

The lead ore from this, as well as the other outcrops, is a cellular gossany material coloured with the yellow oxide of lead, and containing sometimes a little carbonate as well as galena.

About half a mile south of the Boulder Hill is the Granite Castle lode, on which four claims have been pegged. The outcrop of this lode is very prominent in the *Granite Castle* (Clements, Edwards, and Wood) and the *No. 1 West* (Kingston, Taylor, and Beamish) claims (Nos. 10 and 11 on the sketch). Little or no work has been done on the former claim, in which, however, galena and the yellow oxide of lead can be seen in some of the ore, which is in one place slightly cupriferous also. In No. 1 West a hole down 10 or 12 ft. showed the lode formation to be 3 ft. 4 in. in width, and with a hade to the north,

though only a few degrees from the vertical. A sample over this width gave (Government Analyst)—

Gold	18 dwt. 10 gr. per ton
Silver	17 oz. 14 dwt. 14. gr. per ton
Lead	0·4 %

Colours of gold can be got on the sides of the hill below and to the south of the outcrop.

OUTCROP OF GRANITE CASTLE LODE.

In the next claim (Hixon's—*No. 2 or 3 (?) West)* the lode had not been located, but outcrops again in *No. 4 West* (Bachelor's—No. 13 on sketch), where it had not been opened up.

About 100 ft. north of, and parallel to, the lode in the Granite Castle and No. 1 West claims is a dyke of decomposed rock containing porphyritic crystals of hornblende. This dyke continues through to the No. 4 west claim at about the same distance from the lode. A hornblende schist also outcrops in these claims.

On the eastern side of the river a claim (No. 14 on sketch) has been pegged out by Messrs. Sutton, Hunter, and Nolan on an outcrop of another east and west lode. As it had only been pegged the day before my visit, no work had been done on it.

Of the outcrops the Granite Castle lode appears the most promising, but they all deserve to be well tested before being abandoned. Though free-milling ore may be obtained from the surface, it is possible that the lead ores, particularly if any chloride be present, may sicken the mercury and thus hinder amalgamation. This, however, is a question which will need investigation. Inasmuch as some sulphides can still be seen in the surface ore it is unlikely that the oxidised zone will extend to any depth, and the sulphide ore will then present a concentrating or smelting proposition likely to require some capital expenditure for treatment, in which the cost of carriage will form a considerable item.

7. The Granite Castle Lode, Mount Emu Plains Station, Hughenden District.

By W. E. Cameron, B.A., Assistant Government Geologist.

Situation.

The Mount Emu Goldfield is situated on the headwaters of the Flinders River. It is 60 miles north-east of Hughenden, and 57 miles west-north-west of Pentland. Hughenden is 236 miles by rail from the port of Townsville, and Pentland 148 miles from the same place. By road the goldfield is about 66 miles distant, *viâ* Emu Plains cattle station, from Hughenden, and from Pentland it is about 64 miles distant *viâ* Lolworth and Cargoon Stations. Either road would be readily negotiable for conveyance of goods or machinery, the former, as far as I could learn, being probably the better route of the two, though its advantages in this respect might be outweighed by the extra haulage involved in the railway journey between Pentland and Hughenden.

Previous Reports and Recent Work.

The Mount Emu reefs were reported on by E. O. Marks, B.A., B.E., in February of this year, his report appearing in the "Queensland Government Mining Journal" for March last. Between the time of his visit and that of the writer very little work has been done, except the continuation of the sinking of a shaft on the No. 1 West claim on the Granite Castle lode, from a depth of about 10 ft. to a depth of 40 ft. This shaft, by passing from the oxidised surface ore into heavily mineralised ore at a depth of about 20 ft., has served to demonstrate more clearly the character of the unaltered ore that may be expected at shallow depths along this line of reef. No work was going on at the time of my visit on any of the other reefs.

Character of the Granite Castle Lode.

The Granite Castle lode strikes almost due east and west, and stands nearly vertical, the hade for the first 40 ft. in the shaft on the No. 1 West claim being about 10° towards the north. The country rock is granite. The lode can be traced almost continuously from a point about 100 yards west of the right bank of the Flinders River, which here runs in a southerly direction, for about 1,300 ft. to the west as a persistent outcrop of iron-stained quartz. This portion of the outcrop is held as the P.C. and No. 1 West claims, the former extending for about 20 chains along the line of lode and the latter for a further 10 chains. Over most of this distance the outcrop shows from 2 ft. to 3 ft. in width and assays of the surface

stone have given returns of from 6 dwt. of gold to nearly 2 oz. of gold to the ton with silver running from 5 oz. to 10 oz. to the ton. Unfortunately, this oxidised stone gives place at a shallow depth to heavily mineralised stone as disclosed in the shaft on the No. 1 West claim, and the assays of this stone show only about 11 or 12 dwt. of gold per ton of ore and from 5 oz. to 18 oz. of silver. Beyond the No. 1 West claim mica schist takes the place of granite, and a trench across the line of lode on No. 2 West claim has failed to pick up the outcrop. In the No. 3 West claim the outcrop appears again, and a shallow pit shows about 6 in. of white quartz, assays of which are reported to have given only a few pennyweights to the ton.

Prospecting Work and Assays.

Near the eastern end of the outcrop a shallow pit, situated about 120 yards from the eastern boundary of the P.C. claim, exposes about 6 in. of quartz between rotten granite walls. About 30 yards further west a shallow trench shows about 2 ft. 6 in. of rubbly quartz, a sample across which gave on assay—

Gold, 6 dwt, per ton of ore.
Silver, 5 oz. 3 dwt. per ton of ore.

To the west of this trench a strong quartz outcrop can be traced for about 57 yards, when it is hidden by boulders of granite for another 50 yards. Beyond this the outcrop reappears, and is traceable for another 57 yards to a shallow trench which exposes a width of about 3 ft. of quartz. About 60 yards further west a pit, about 5 ft. in depth, shows from 1 ft. to 2ft. of rubbly quartz, an assay of which gave a return of—

Gold, 16 dwt. 5 gr. per ton of ore.
Silver, 6 oz. 5 dwt. 5 gr. per ton of ore.

About 20 yards past this hole is the boundary between the P.C. and No. 1 West claim, and the outcrop can be traced for another 100 yards further west to a pit about 3 ft. in depth. This pit shows 20 in. of quartz on the hanging-wall separated by a 2-ft. horse of granite from about 5 in. on the footwall. An assay across the quartz here gave a return of—

Gold, 1 oz. 19 dwt. 5 gr. per ton of ore.
Silver, 9 oz. 10 dwt. 14 gr. per ton of ore.

About 30 yards further west is the shaft referred to previously, which met with mineralised stone at a depth of about 20 ft. It exposes at a depth of 40 ft. a lode about 2 ft. 8 in. in width, consisting of parallel veins of heavily mineralised quartz in decomposed granitic formation. It lies between well defined granite walls with a slight hade to the north.

A sample taken by Mr. Marks from 10 ft. or 12 ft. down the shaft over a width of 3 ft. 4 in. gave a return of—

Gold, 18 dwt. 10 gr, per ton of ore.
Silver, 17 oz. 14 dwt. 14 gr. per ton of ore.
Lead, 4 per cent.

A sample taken by myself of the mineral stone from 40 ft. down the shaft gave a return of—

Gold, 11 dwt. 5 gr. per ton of ore.
Silver, 5 oz. 6 dwt. per ton of ore.

A sample of about 17 cwt. from this shaft, sent to Cockle Creek Smelting Works for treatment, gave on assay—

Gold, 12 dwt. 0 gr. per ton of ore.
Silver, 18 oz. per ton of ore.
Lead, 1·8 per cent.
Arsenic, 4 per cent.

Character of the Unoxidised Ore as Affecting the Treatment.

The sample of mineral stone from the shaft on the No. 1 West claim, when crushed to pass through an 80 mesh screen and panned off in a dish, gave a concentrate of about 26 per cent. of the weight of the sample, the bulk of the mineral being iron and arsenical pyrites and zincblende. The presence of such a large proportion of mineral of this character in the ore would no doubt seriously interfere with the extraction of the gold and silver values. Without the appliances of a metallurgical laboratory, it is impossible to determine satisfactorily what extraction could probably be obtained by a battery under different degrees of crushing of the ore, but an attempt at amalgamation in the laboratory indicated that the gold is so fine that its amalgamation under any circumstances is likely to be very troublesome. Assuming, however, that 60 per cent. of the gold and 40 per cent of the silver could be extracted by fine crushing or grinding and cyaniding, the value of the ore from the No. 1 West shaft recoverable by battery treatment would be somewhere about 32s. per ton. The question of whether the concentrates could be further profitably dealt with could only be satisfactorily determined after the percentage of extraction by amalgamation had been arrived at. Assuming, however, that 60 per cent. of the gold could be obtained by the battery, there is very little prospect that the concentrates from ores of the grade found in the No. 1 West shaft would be of sufficient value to ship to smelters.

Possibilities of the Lode.

The Granite Castle lode is apparently persistent over a length of about 1,300 ft., and it seems likely, judging by the outcrop and the few shallow workings on it, that it will average from 2 ft. 6 in. to

3 ft. in thickness over most of that length. It lies almost vertically, and apparently between well defined walls of granite. These conditions should render its mining a comparatively cheap proposition, and if carried out on a considerable scale it should not cost more than 20s. per ton to extract. With 10s. a ton added for treatment by amalgamation and cyanidation, it seems probable that 30s. a ton should cover all operating expenses if the deposit were worked on an adequate scale. If, therefore, a 60 per cent. extraction of the gold could be relied upon, and if systematic development should expose adequate supplies of ore of the value of that found in the shaft on the No. 1 West claim, it seems probable that the returns from this reef could be made to pay for the expenses at least of mining and treatment. Any small increase, however, in the expenses of mining, or decrease in the value of the ore, or failure in the amalgamation of the gold, would turn the enterprise into a loss, and in any case it would be necessary to find much richer ore to allow for the repayment of the expenses that would have to be incurred in equipping the mine with plant.

It is quite possible, however, that the general average of the ore below the zone of oxidation in this reef may be of better value than is indicated by the assays from the No. 1 West shaft, and may also be less charged with mineral and consequently more amenable to treatment by amalgamation. The long and persistent outcrop and fair size of the lode, taken together with the fact that it has proved gold-bearing wherever opened out, render it a fair prospecting proposition, and it appears to me to be well worth the expenditure of a few hundred pounds in further exploration of its resources. Further exploitation should take the form of sinking on another portion of the lode, say 300 ft. east of the present No. 1 West shaft, and, if the results warrant it, the question of driving on the lode in the unoxidised ore and sinking exploratory shafts at other points along the line could then be considered. The fact that the lode is held as two claims, extending respectively about 740 ft. and 540 ft. along the line of lode, detracts from its value as a prospecting proposition and possible mine, as it would no doubt restrict the economic development of the lode in various ways, if further exploration should warrant its systematic development. In any case, however, before any large expenditure is incurred the question of whether a profitable extraction of the values could be made in a battery should be finally settled.

In order to determine what percentage of extraction can be obtained by amalgamation, it will be necessary to dispatch a few tons of representative ore to a battery for trial treatment, provided that arrangements can be made for the fine crushing that will apparently be necessary for a satisfactory return. The possibilities of other methods of extraction such as complete sliming and cyaniding, with

or without roasting of the concentrates for further treatment, would appear to be debarred by their comparatively high cost, and in any case their consideration may well wait until further development has proved the existence of ore of sufficient size and richness to warrant their consideration.

A sum of £500 should be sufficient to carry out the further preliminary prospecting of the lode as recommended above. This should allow of the sinking of another shaft, say 100 ft. in depth, at a point about 300 ft. east of the present No. 1 West shaft, and of the dispatch of a lot of about 20 tons of ore to a Charters Towers battery for trial treatment, provided the assays of the stone taken in sinking the shaft warrant the expenses of such trial treatment.
30th September, 1910.

8. Prospecting on Cape River Goldfield.

MEMO. *RE* APPLICATION FROM RESIDENTS FOR ASSISTANCE IN PROSPECTING THE FIELD.

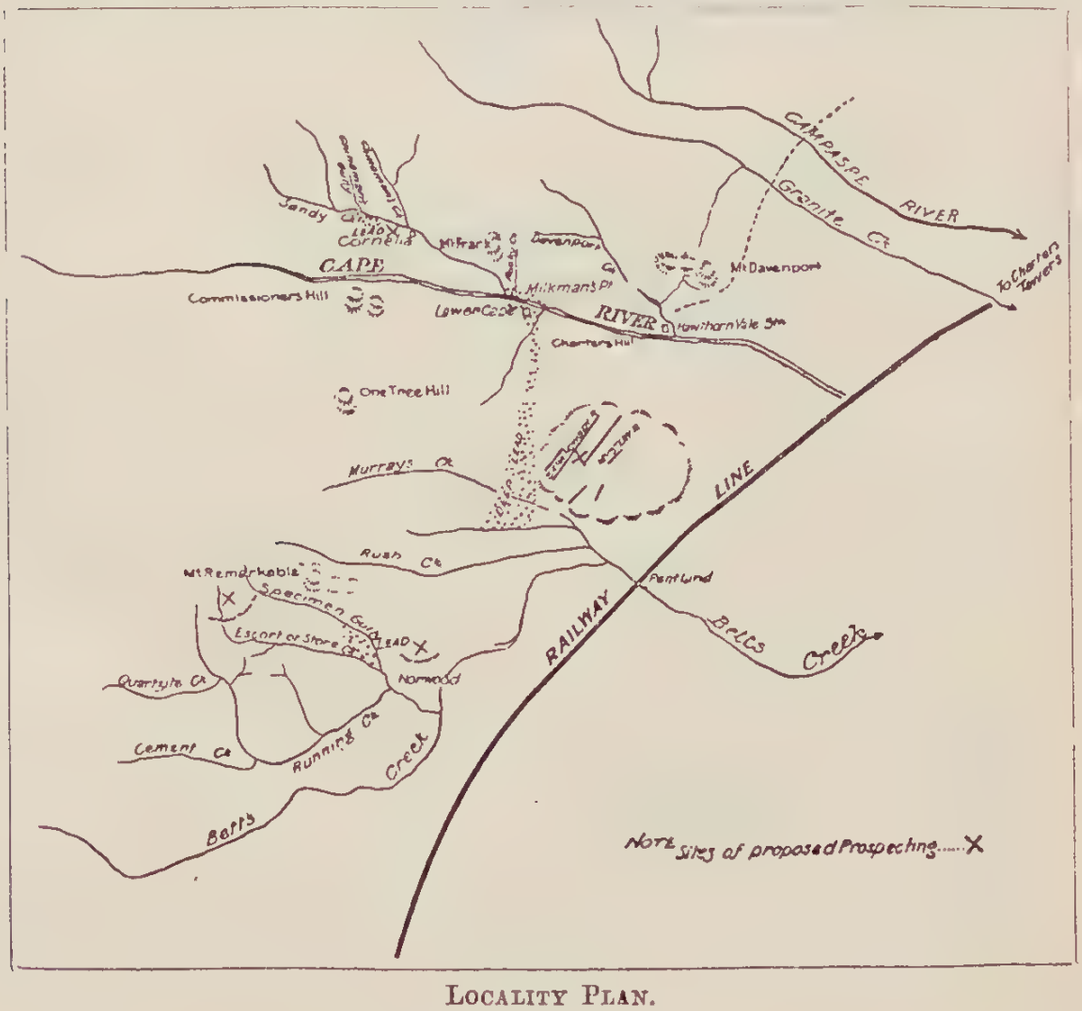
By E. O. Marks, B.A., B.E., Assistant Government Geologist.

In the application mention was made of four separate localities which, in the opinion of the petitioners, should be prospected, viz.:—

1. Gray's Flat, between Norwood and Rush Creek.
2. Cornelia.
3. Tableland, west of Mount Remarkable.
4. Sarah Houston, or Mystery Reef.

The first three are in alluvial ground, Nos. 1 and 2 being thought possibly to be continuations of the "Deep Lead," with leads worked at Specimen Gully and Sandy Creek respectively.

Before considering the alluvial propositions, it is well to recall that the Deep Lead and its probable continuation north of the Cape River at Milkman's Point was the source of most of the alluvial gold got on the Cape, and at one time supported a population of 3,000. The Deep Lead was described by Mr. Rands in his report



Locality Plan.

on the Cape River Goldfield in 1891 and subsequently in 1894. From Mr. Rands's reports and information gathered on the spot, it appears to have been narrow at the north end and to have widened out or become poorer to the south. The conditions under which the gold was concentrated are difficult to understand, as the usual theory of an old river channel must be modified in view of the fact that the rich "wash" occurred in a north and south belt regardless of the surface contours of the bed rock. Whereas exceptionally rich ground was obtained on Red Hill at a depth of not more than 2 ft., west of this in low ground where the bottom was 30 ft. deep the gold found was not payable.

The lead was worked again in 1894 at the southern end of the old workings. South of this, again, trials have been made on Rush Creek, but no payable gold discovered.

1. Between Rush Creek and Norwood.

The country here is a similar formation to that which covers the leads at Specimen Gully and Sandy Creek, and forms the tableland west of Mount Remarkable. At the latter place it has been mapped by Mr. Rands as Desert Sandstone, though of the age of the leads he was unable to form any opinion. The formation is similar as well to a tableland, also considered to be Desert Sandstone, east of the Deep Lead, on which Conyngham's (or the Chemist's) shaft was sunk. This latter was unsuccessful, only a few colours of gold being obtained. There is a slight escarpment on the south of the position now suggested, and colours of gold are said to have been obtained in the gullies at the foot of the escarpment. It is also considered that as this position is more or less on a line with the Deep Lead, and between it and the lead at Specimen Gully, a trial should be made. As already pointed out, the ground on Rush Creek between this and the Deep Lead has already been tested, with unfavourable results. The workings on the lead at Specimen Gully, which must not be confused with the rich alluvial workings in the bed of the present stream, do not appear to have been very successful, and there is little reason to suppose that the gold found was the same run as the Deep Lead. It would be wellnigh useless to sink a single shaft and drive in the locality suggested, merely on the off-chance of striking a payable run of gold; and the making of a series of shafts and drives (probably of considerable depth), such as would be necessary to properly prospect the ground across the supposed continuation of the lead, would involve an outlay not justified by the prospects.

It appears that this locality is erroneously named "Gray's Flat" in the petition.

2. Cornelia.

Near Cornelia Station two or three shafts have been sunk close to the outcrop of a large white quartz reef. One shaft, 17 ft. deep, is reported to have produced a few pennyweight slugs of gold; another

shaft, 30 yards further west, did not bottom at 40 ft., the water being too heavy for further work. The supposition is that the ground here is the continuation of the lead worked further up Sandy Creek and of the Deep Lead. The formation is probably the same as that covering both the Sandy Creek and Deep Lead, but there appears no reason to suppose that the gold wash continues in this direction. If the shafts already sunk had been anyway promising, it is certain that more work would have been done at the time. The Government prospecting party in 1891 did some work round the Sandy Creek lead, but without success, and there is little to encourage further blind prospecting in the neighbourhood.

3. Tableland, West of Mount Remarkable.

This Tableland is situated at the heads of Specimen and Store Creeks on the south and Rush Creek on the north. The very rich alluvial gold obtained in Specimen Gully probably had its origin in the numerous reefs which have been worked in the locality. That gold, however, occurs under the formation of the tableland there is no doubt, for at the head of Store Creek gold has comparatively recently been obtained in a tunnel on the surface of the underlying granitoid schist. As the operations have been suspended they presumably became unremunerative. From the levels at which the bed rock outcrops it has been suggested that an old valley now covered by the tablelands exists in this neighbourhood, and that it would probably form an auriferous lead.

While the first contention has a certain degree of probability, to decide which a closer examination would be necessary, there is little reason to assume that the ground would contain payable gold. As already pointed out, the Deep Lead does not appear in any way to be governed by the present levels of the bed rock, and it is probable that if a lead exists west of Mount Remarkable it would have been deposited under conditions similar to the Deep Lead.

One shaft has already been sunk on the tableland, but whether it reached "bottom" is unknown. Had a rich lead been followed from the side under the tableland, it might have been reasonable to prospect, but since no such payable lead has so far been discovered the chances of striking one by shaft-sinking and driving therefrom is extremely remote. A further objection to these three propositions lies in the fact that they are all alluvial, and in the event of a successful outcome the discovery besides benefiting the finders would only be of temporary benefit to the field.

4. Sarah Houston and Mystery Reefs.

These and other reefs in their immediate neighbourhood have been suggested as requiring further prospecting. Unlike the reefs near Mount Remarkable and at Mount Davenport, in which the gold occurred only when a cross-reef intersected the main reef, these appear

to have been more continuously gold-bearing. The only information about them is in the report of Mr. Rands, who makes the following remarks concerning this group of reefs:—"These reefs have been worked at a great disadvantage on account of there being no machine at hand. The expense of cartage to Charters Towers has prevented their being more thoroughly tested. I have very little doubt, from trials I made of stone which had been discarded, that there are many tons now at grass which would yield about 1 oz. of gold to the ton. The reefs are of good size, and are composed of a good character of stone. They are well worth another trial."

Only one effort has been made since Mr. Rands's visit to work these reefs—on the Sarah Houston, and it is doubtful whether the shaft then sunk was really on the reef. It is unlikely that the reefs were worked deeper than 100 ft., and only on the richer shoots. It seems very probable that the ore not payable under the conditions then prevailing—previous to the introduction of the cyanide process—would, with modern treatment and appliances, be profitable to work. It is said that mullock brought up from sinking a shaft on the Sarah Houston crushed 8 dwt. to the ton in a small battery, with probably imperfect recovery of the gold. Inasmuch as most work appears to have been done on the Sarah Houston reef, which is also a wider reef than the Mystery preferred by some of the petitioners, it is natural to conclude that this reef would be the most suitable for investigation should it be decided on. An examination of the reef to determine the nature of the ore left, and *not* a search for any fresh shoot of rich ore, might be made with little further outlay than that necessary to unwater the mines. In the event of the reef proving satisfactory a large outlay on modern plant, both for mine equipment and for treatment, would be necessary—an outlay which could probably not be raised in the locality. On purely geological grounds the reefs certainly offer good prospects. Should the proposition be favourably considered, it would be essential for the Department to see that the work was carried out in a manner suitable for the purpose of investigating the reefs, as there are few men on the field capable of the undertaking, and there would be a tendency to prospect for rich shoots which, while more satisfactory to the man without capital, would be unlikely to lead to any permanent benefit to the mining industry.

Brisbane, 2nd March, 1910.

9. Gold on Witty's Freehold, Ormeau, Por. 239, Parish of Albert.

By W. E. Cameron, B.A., Assistant Government Geologist.

This freehold is intersected by the South Coast Railway line, being about a mile on the Brisbane side of Ormeau Station. The workings are on the north-eastern side of the railway line. Some ten or twelve trenches and four shallow shafts have been dug over an area some 20 chains in length in a north and south direction by 2 chains in width. The trenches have exposed bodies of quartzite running up to 60 ft. across and up to 10 chains in length. Bulk assays of samples weighing 50 or 60 lb., taken by the owners from several of the trenches, are reported to have averaged from 2·6 dwt. to 4 dwt. of gold to the ton. The quartzite rock for 5 or 6 ft. from the surface is iron-stained, and shows vertical cleavage striking in a north and south direction, and giving the impression in surface workings of vertical bodies likely to go down for considerable distances, and capable of supplying large quantities of ore. Below a depth of 5 or 6 ft. the iron-staining and signs of cleavage disappear, and a compact granular quartzite, impregnated with scattered grains of arsenical pyrites and seamed through with veins of glassy quartz, makes its appearance. The presence of gold in this rock is probably associated with the presence of these veins of quartz and crystals of arsenopyrite.

It was considered by the owners that the prospects of the improvement of the stone with depth were sufficiently good to warrant the hope that, with such apparently large bodies of stone, a payable proposition could be proved by the expenditure of a moderate sum in further development. A study of the deeper workings, however, shows that there is very little likelihood of the stone already developed continuing down more than a few feet. Towards the northern end of one of the bodies of gold-bearing stone an old shaft, known as McGhie's shaft, is situated, and is reported to have been sunk to a depth of 88 ft. It is now filled up to about 18 ft. from the surface. The first 12 or 14 ft. shows hard quartzite rock underlain by soft clay schists, having a vertical north and south cleavage. A drive east for 33 ft. passes through the same clay schists, with a roof of hard quartzite above, the division between the two formations rising towards the end of the drive. A drive also goes west from this level, through the same schists, for 20 ft., where it connects with a second shaft to the surface. The division between the clay schists below and the overlying quartzite rock is passed through in the shaft, and dips here flatly to the west.

This work demonstrates the fact that the quartz bodies cropping out on the surface were originally horizontal beds of sandstones underlain by mudstones. Horizontal pressures acting from east and west have metamorphosed the mudstones into clay schists and the sandstones into quartzites. Siliceous solutions have invaded the latter, which, on account of their hardness, would be considerably fractured by these pressures, and have resulted in the deposition of quartz veins ramifying in all directions through the original quartzite. The pyritic mineral has been introduced either by the same agencies or by pneumatolitic action.

The underlying clay schists do not appear to be gold-bearing; the rarity of fractures in such soft material having probably not allowed of their impregnation to any extent by the gold-bearing solutions or vapours.

The quantity of gold-bearing material, therefore, depends entirely on the depth to which the quartzites can be expected to continue before the underlying clay schists are met with. The workings at McGhie's shaft prove that the quartzites there occur merely as a cap some 12 ft. in thickness over the underlying clay schists. As there is no reason to expect that the other outcrops are in any way different in structure, there does not seem much probability that any of them will continue to useful depths.

A shallow shaft sunk on the eastern end of the C.W. trench would probably, however, demonstrate the accuracy of this explanation of the manner of occurrence of the gold-bearing stone beyond any question.

10. The Tin Lodes of Sandy Creek, Charters Towers District.

By W. E. Cameron, B.A., Assistant Government Geologist.

These mines were visited in March, 1910, and again at the end of July of the same year. They lie about 64 miles north-west of Charters Towers. the road via Hillgrove Station and Stockyard Creek battery being generally reckoned at about 80 miles. The lodes so far opened up all occur in granite country, which is surrounded by slates and mica schists. These slates and schists are probably much older than the fossiliferous beds, of Devonian age, mapped as occurring over this area on the State geological map, and described by Dr. Jack as occupying a great part of the valleys of the Burdekin and Clarke Rivers.

The mines at present working are all within an area some two miles square, but the tin-bearing country extends as far as Stockyard Creek, about 14 miles to the east, where a few small lodes and a considerable amount of alluvial were formerly worked, and where a five-head battery has treated most of the ore from the Standard Mine at Sandy Creek. A small three-head battery on Sandy Creek itself has treated the bulk of the crushings from the Lucky Hit and smaller mines.

The Standard and Lucky Hit have been the most productive lodes, and are situated close to each other, about a quarter of a mile from the Sandy Creek battery; while the Ruby, Mystery, and McMahon's lodes are about a mile further west. The two former mines were discovered in 1907, and up to August, 1910, had furnished, according to the Warden's books, £3,069 10s. and £2,385 10s. worth of tin respectively. This tin had all been obtained within a distance of 50 ft. from the surface, and being easily won had proved very remunerative to the lucky prospectors.

During the interval between my first and second visits a syndicate had taken over the three claims on the Standard and Lucky Hit lodes, and had started to crosscut from one to the other with the idea that the whole country between was a large tin-bearing dyke, in which other veins of rich ore would be found.

After cross-cutting about 60 ft. through granite, this idea had to be abandoned, and since then I understand some sinking has been done on the lodes, but with what results I have not been able to learn.

The two lodes run, roughly, parallel with each other, striking a little west of north and dipping steeply to the west. The westernmost—the Standard lode—has been worked over a length of 190 ft., and has a very regular strike at about north 25 deg. west. The eastern-most—the Lucky Hit—runs parallel with the Standard at its southern end, but as it is followed to the north its bearing swings round till it is nearly north and south. They are about 140 ft. apart at their southern ends and about 160 ft. at their northern end.

The occurrence appears to be due to the alteration and replacement of the granite along well-defined fissures, which give promise of a considerable amount of persistency with depth. The ore from the Standard Mine has up to the present averaged about £11 per ton, and that from the Lucky Hit about £10 per ton. In order to maintain this high percentage it has been necessary to discard a considerable amount of poorer material, which would pay to treat with more efficient appliances, and the output of ore has consequently not been as great as the size of the lode would lead one to expect. The Standard Mine had crushed some 271 tons, and the Lucky Hit some 238 tons during 1907 to August, 1910, the returns being 39 tons 4 cwt. and 28 tons 17 cwt. respectively of black tin.

The Standard Lode.

This lode has been worked open-cut over a length of about 190 ft. and to a depth of about 20 ft., the walls of the lode being about 10 ft. apart. The altered granite "formation" between these walls is a tough dark coloured rock, in which the felspar and ferro magnesian minerals have been altered to an amorphous kaolin material, coloured a greyish blue, probably by oxides of iron. Two veins of rich tin bearing material, each about 1 ft. in width, run with considerable regularity through the formation, the hanging-wall vein lying close against the well-defined hanging-wall, and being separated by about 2 ft. of "formation" from a second vein underneath it.

A shaft has been sunk to a depth of about 60 ft. about one-third of the distance along the open-cut workings from the southern end, and from levels driven north 60 ft. and south 43 ft. most of the ore has been stoped out to the open-cut above. The comparatively small amount of ore that has been crushed from this work shows that a great deal of the lode material has been

rejected in order to keep the crushings up to the high percentage necessary to prove remunerative with the long haulage to the battery on Stockyard Creek, where most of this ore has been crushed. This is also evidenced by the fact that the mullock heaps have already been picked over and afforded a considerable quantity of fair quality stone. The returns show that 271 tons 1 cwt. of stone were crushed from these workings up till June of last year, for a return of 37 tons 9 cwt. of tin, valued at £3,069 10s.

The considerable length over which rich ore occurs in this lode and its well-defined character give prospect that it will became a valuable little mine when developed by further sinking.

The Lucky Hit Lode.

On this lode two shafts have been sunk, at a distance of 22 ft. from each other, towards the northern end of the outcrop, the northern to a depth of about 55 ft. and the southern to a depth of about 45 ft., the lode dipping at about 60 deg. to the west. Most of the ground to a depth of about 33 ft. between these two shafts, and for a distance of about 35 ft. to the south of the southern one, has been worked out to the surface. No driving has been carried out to the north of the northern shaft, where the lode shows about 1 ft. in thickness. The amount of ore that has been crushed from this ground (about 238 tons) is equivalent to an average of about 1 ft. in thickness over a length of about 80 ft., and of a value of about £10 per ton. A crosscut has been driven in a westerly direction from the southern shaft for a distance of about 60 ft., but has disclosed nothing but granite. The outcrop of the lode can be traced to the south for about 180 ft. from the southern shaft, but no work has as yet been done on it except at the southern end. Here an open-cut, about 25 ft. in length, shows good tin irregularly distributed over a width of some 8 or 10 ft., from which good crushings are reported to have been obtained. About 60 ft. south-west of this open-cut McCready's shaft, on a block claim, has been sunk to a shallow depth, in the hope of picking up this "chute" of ore. A crosscut has been put in about 47 ft. from the bottom of this shaft in the direction of the open-cut, but has as yet failed to pick up its continuation. This lode gives promise of considerable persistency both in length and depth, and both it and the Standard lode are well worth the expenditure of further development by sinking below the depths possible with the present equipment of windlass and bucket. It is reported that sinking by means of a horse and whip is now being carried out, and that, if developments are sufficiently favourable, an attempt will be made to raise funds to erect an efficient battery near the mine site, and thus develop the lode more economically than has been possible up to the present.

The Ruby Lode.

On the Ruby lode two shafts have been sunk near each other on what is apparently a large lode; but, as the outcrop is not well-defined on the surface, and no driving of any consequence has been done, the length of shoot and average size of the lode cannot be estimated. Up till July, 1909, there had been crushed 87 tons of ore from this mine, which returned 4 tons 11 cwt. of tin stone, valued at £375 4s. A further crushing was being put through in July of last year, but it was not complete at the time of my visit. The size of the lode in the shaft and value of the stone certainly warrant more systematic development than has as yet been attempted.

The Mystery.

The Mystery is a small north-and-south reef in granite, lying about half a mile south of the Ruby, and has been sunk on by two shafts, about 50 ft. apart and 40 ft. deep, between which most of the lode has been stoped out. It has furnished about 62 tons 8 cwt. of stone, from which were obtained about 2 tons 16 cwt. of tin stone, valued at £216.

McMahon's Lode.

McMahon's lode is apparently small, and one crushing of 12 tons from a shallow shaft, which could not be inspected, gave a return of 12 cwt. of tin stone, valued at £50.

Brisbane, February, 1911.

II. Olivines in the Toowoomba Basalts.

By W. E. Cameron, B.A., Assistant Government Geologist.

During the last twelve months some attention has been paid to the occurrence of olivines, of a size and colour suitable for cutting and mounting in jewellery, in the basalts of the Toowoomba Range. The occurrence of these gem stones has apparently been known for a number of years, as Mr. Hyde, gem-cutter, of Brisbane, informs me that they were first brought to his notice by Mr. Thistlethwayte, then an engineer in the Railway Department, some 30 years ago. They were not at that time considered of sufficient value to be worth cutting. The place from which Mr. Thistlethwayte obtained his samples was probably a quarry at the side of the railway line, about a quarter of a mile towards Murphy's Creek from Spring Bluff. This quarry has been cut into a cliff of basalt, and was evidently used for obtaining ballast in the construction of the line.

The mineral was first brought seriously under the notice of jewellers by Mr. Gavin, station-master at Spring Bluff, who, in 1909, obtained a parcel of stones from the quarry near Spring Bluff and from other localities in the neighbourhood. These were cut and exhibited at the Franco-British Exhibition in London, in that year, by Messrs. Flavelle, Roberts, and Sankey, jewellers, of Brisbane, but I am informed by Mr. Sankey, of that firm, that they proved too pale in colour to provoke offers from any of the Continental buyers that inspected them.

Mr. Walker, jeweller, of Toowoomba, informed me that he has been despatching from 13 oz. to 14 oz. per week of the rough material to gem-cutters in Europe, and that he could find a market for about 100 oz. a week if the material were forthcoming. The price he is prepared to pay for suitable material is 30s. per oz.

In mineralogy all material of whatever colour having a certain definite form of crystallisation and specific physical character, and being a compound of silicates of iron and magnesia, is known as olivine. In the jewellery trade, however, this name is now confined to the brighter and more valuable emerald green varieties which are suitable for the better classes of jewellery. Julius Wodiska, in his recent work "A Book of Precious Stones," in speaking of this class of stones, quotes W. R. Catelli's book entitled "Precious Stones," thus: "At present it is customary to call those stones which incline most to yellow 'chrysolite'; the

yellowish green resembling a light tourmaline with a dash of yellow, is known by the name ' peridot,' given to it by the French jewellers; and ' olivine' is the name associated with the brighter yellowish emerald green variety, although originally the yellow to olive green varieties were known by that name.'' The nomenclature thus defined appears to be that most favoured by leading dealers in gem stones, though it is well known that several other varieties of bright green stone, such as green garnets and tourmalines, are often sold as olivines, whereas olivines themselves are frequently passed off as emeralds.

The true ''olivines'' under the terminology above referred to do not appear to have been found in the Toowoomba basalts, the occurrences having so far been confined to the paler peridotes and the yellow chrysolites. These stones are quoted in the London market at from 2s. 6d. upwards per carat, while olivines are quoted at from 15s. per carat, the value of the stones rising with increase of colour and transparency.

The price paid in Toowoomba for the rough material is equivalent to about 5d. per carat, or, allowing for a loss of one-half in cutting, to 10d. per carat of cut material, which, with 1s. per carat for cutting, makes the cost about 1s. 5d. per carat. This leaves about 1s. 1d. per carat for incidental expenses and profit, with the class of material found near Toowoomba. These are probably, however, the lowest quotations for stones of small size, and considerably higher profits might be expected from stones exceeding one carat in weight. Apparently, however, the bulk of the material is smaller than this, though stones up to 6 and 7 carats cut have been found. The greatest difficulty probably is in obtaining a sufficient quantity of material of good enough colour and transparency.

The basalts of the Toowoomba Ranges are exposed as a cliff face over a number of miles to the north and south of Toowoomba, and the olivines occur in nodular patches up to a couple of pounds or more in weight. These nodules are, however, composed of innumerable small grains, a great proportion of which are too small for cutting purposes. Boulders falling from the cliff face of the basalt are strewn along the lower slopes of the cliffs, and expose numerous kernels of olivine material. These boulders have for the most part been considerably weathered since their fall from the cliffs, and the olivines thus exposed on their surface, being very susceptible to weathering influences, have generally been deprived of a good deal of their depth of colour and brilliancy, and are thus in most cases too pale to be of any value as gem stones.

The unaltered material has thus mostly to be obtained by breaking open the boulders, and this operation, owing to the hardness of the basalt, leads to the breaking up and scattering of a large proportion of the material, and its consequent loss. In any case, however, there appears to be abundant material to meet the demand, and the reported deficiency of supply is probably due to the fact that, in a settled agricultural district such as Toowoomba, with a population used to farming pursuits at regular wages, the uncertainty of the method of payment by results, incidental to this class of industry, and the somewhat unusual character of the work, do not afford sufficient inducement for the abandonment of the ordinary occupations. There is a possibility also that the recovery of material, suitable to buyers at the price above quoted, in sufficient quantity to give a reasonable wage, would be more difficult than would at first appear from the abundance of the material showing in the cliff face.

At the time of my visit I was unable to find anyone actually engaged at the work, although a number of points from which material has been obtained were visited. The most prolific spots so far reported appear to be: The quarry below Spring Bluff Station and the mountain opposite and across the line, the range face near Harlaxton, the Wallaby Rocks on the Peninsula, and the base of One-tree Hill, while numerous other points along the range have also furnished material.

Brisbane, February, 1911.

By Authority: Anthony James Cumming, Government Printer, William street, Brisbane.